

DOCUMENT RESUME

ED 202 707

SE 035 005

AUTHOR Etlinger, Leonard E.; Ogletree, Earl J.
TITLE Calculators and Microcomputers for Exceptional Children.
PUB DATE 81
NOTE 9p.
ELRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; Achievement; *Calculators; Computer Assisted Instruction; Consumer Education; Educational Technology; Elementary Secondary Education; *Exceptional Persons; *Mathematics Education; Mathematics Instruction; *Microcomputers; *Special Education; *Student Motivation

ABSTRACT

The potential of using calculators and microcomputers successfully with exceptional children is addressed. This document features specific devices and models when referring to applications of calculators in the classroom. For the exceptional or handicapped student, calculators are viewed as the "least restrictive" learning device; which are destined to become more prominent in the classroom. The microcomputer is viewed as a device of the future, which appears to have great potential for adaptability. Currently available software functions and innovative devices such as speech synthesizers are noted, but no particular brands or models are described. The document concludes with a list of five ways calculators and/or computers can benefit students. The reasons listed are: (1) reinforcing the basic skills; (2) helping in the basic skills of reasoning; (3) reinforcing problem solving ability; (4) promoting logical thinking; and (5) encouraging creativity. (MP)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

ED 0202707

Calculators and Microcomputers
for Exceptional Children

Leonard E. Etlinger
and

Earl J. Ogletree

To what extent can calculators and microcomputers be successfully used with exceptional children? This inquiry was the basis of a Chicago State University workshop by the National Science Foundation. Participants included administrators, teachers, librarians, and consultants working with exceptional children. The workshop included lectures, demonstrations, and hands-on experiences and discussions. This paper will present the activities in the format of an article rather than a report.

The evaluation of technology in the school saw the introduction of teaching machines, programmed materials and educational television in the 1960's to hand-held calculators in the 1970's and minicomputers in the 1980's. The low cost and availability of calculators have increasingly made them an accessible instructional tool for all students. The calculator can be an innovation teaching tool to enhance understanding and achievement in mathematics.

The calculator has two applicable functions in the classroom, a practical function, and a pedagogical function. As a practical function, the calculator is considered as a device much like an eraser, and chalk, paper, and pencil--- a tool that can do the work involved in tedious arithmetic computation. The calculator is a

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

EARL J. OGLETREE

SF 035 005

time-saver and an anxiety reducer. The pedagogical function of the calculator is much like a textbook, flashcards, or a manipulative device; it facilitates learning and enhances understanding and competence.

For the exceptional or handicapped student, the calculator can be the "least restrictive" learning device. The practical function of the calculator involves obtaining a usable answer with the least effort in the minimal time. Since the calculator is fast and effortless, trial and error reinforcement techniques for finding answers can easily be used.

The extent of applicability of calculators with handicapped children will vary from individual to individual. Many handicapped students function well with one digit numbers using paper and pencil calculations. When it comes to multiple digit numbers, paper and pencil calculations may be beyond their capabilities. But the calculator provides a practical bridge between success and failure. It permits the student to progress to a higher level of competence. Many handicapped students lack good memory retention. In the past, multiplication and addition tables and charts were the only personal reference for students attempting to recall the basic arithmetic facts. The calculator not only provides the basic facts, but allows the student to easily go beyond the traditional tables.

In instances where students have had bad experiences with

mathematics or fear mathematical problems that entail extensive computation, the calculator allows students to concentrate on the solution to the problem. The calculator also permits them to check and recheck their answer as well as finding different methods of solving the problem by trial and error. Using the printing calculator the student has a printed record of the process and solution. He could also check for digit reversals and compare processes and answers. Since most calculators do not have printers and problems and processes must be retained in the student's mind, the Sharp 5100 or 5010 with the LCD, rolling writer display-- is a solution. The rolling writer displays numbers, letters and symbols of up to 80 characters including direct formula entry with up to 15 levels of parentheses and 11 data memories (six for the 5101).

For the beginning, young, or exceptional, the game-practice devices such as "Dataman" and "Little Professor" are highly motivational for reinforcement and drill. Perhaps the most important aspect of mathematics for the slow, handicapped or potential dropout student is learning basic arithmetic skills and their applications, as with the ability to make change and to use a cash register. The Cosis #C11Er Mini Electronic Cash Register has a quick print 11-digit system and 7-digit Digiton display with automatic change calculation, simple repeat registering, and is relatively inexpensive at \$99.95 and easy to use.

Student's confidence and motivation can be enhanced by the teacher's use of the "EduCalc", a two display unit. It has the usual small, red numerical readout facing the teacher as he operates it, and a big display unit showing the same numerical display on the side facing the students. (The "EduCalc" is distributed by Educational Calculation Devices, Inc., Laguna Beach, California). The Overhead Demonstration Calculator can also be seen by a classroom of students or a large audience (Distributed by Stokes Publ. Co., Palo Alto, California).

The Sharp 827 "Play a Tune" calculator has 11 music notes and plays a tune while math problems are solved. The additional aural clue would be helpful for the slow, partially-sighted or the student with an aural-memory. The APH Student Plus Talking Calculator, which has 24 words of the vocabulary, keys from 1-10, four operations, equals, root, memory, etc. and six arithmetical functions, with keys with highly visual notations, is for low vision students. (Distributed by American Printing House for the Blind, Louisville, Kentucky; price \$395.99). Panasonic also has a Talking Calculator (#Pan 1650) with audible and visual playback for the sight-impaired.

It appears the calculator will come to play a more prominent role in the classroom with regular and exceptional students. Recent research shows that educably mentally handicapped students, in the main, do not acquire arithmetic skills much beyond the fourth grade level.

The calculator can help the student exceed this level of achievement. However, special consideration needs to be given to adapting the device to the various special needs of handicapped students. The special adaptations should include large keys and large digital displays, including, optimal, auditory responses for keying and printing. For the sight-impaired, braille keys and braille printer, tapes should be incorporated in the calculators.

A more recent instructional device that is being increasingly used in the schools is the microcomputer. It may replace the calculator in that the microcomputer performs all the functions of the calculator in addition to being easily programmed to store and retrieve specific requested data, ask questions, and evaluate and report student's responses. Unlike the computers of a decade ago which filled several rooms and cost millions of dollars, the microcomputer today, such as the TRS-80 or Apple, is a light-weight typewriter keyboard and small television monitor, costing, in many cases, less than \$1,000.00. The size of the keyboard and the display screen is compatible for use in schools. Displays are in black and white or color, depending on the model.

Computer Assisted Instruction (CAI) is an integral part of microcomputer "instruction". Courseware in multi-subject areas such as reading, mathematics, language arts, social studies, science, etc., is becoming available for all grade levels. The courseware ranges from teaching kindergarten students to count, to advanced

courses in physics and statistics. Microcomputers have many of the same educational advantage features as calculators. Instruction can be highly individualized. Micros can be diagnostic tools for evaluating students. They are non-threatening to the student and can be programmed to correct and give praise, e.g., "Very Good, John," or "Keep up the Good Work". The microcomputer is used as a supplementary approach to learning, drill and reinforcement. It extends the teacher's time to provide additional instruction and individualized help to other students.

Software presently available includes a teacher-aide program for determining class grade distribution, an IEPs program for special education students, class listing, equipment and book inventories, cumulative achievement score reporting, and health and psychological data records for individual students and the class. The microcomputer can store and make printed copies of all information. This data is stored on cassettes or diskettes. The data can also be edited and revised without retyping the original information.

An innovative device developed for the microcomputer is the speech synthesizer. It can be programmed to orally respond to the student's typed question, statements or responses. It could be helpful to the non-verbal or visually impaired student. A more recent innovation in microcomputers is the "Talk Box" in

which the microcomputers are programmed to be sensitive to the nuances of a particular voice.

As an instructional aide for exceptional students the microcomputer appears to have great adaptability. It can measure the student's performance and adjust the difficulty of the problems in a non-threatening manner. As the student successfully completes a skill or a concept the microcomputer can generate more difficult problems. It can also provide easier problems when the student indicates, by his responses, that he is having difficulty.

Calculators and microcomputers are here to stay. With the reduction in school budgets, the need to provide individualized instruction (IEP's) and the mainstreaming of exceptional students, the inclusion of these devices as instruction tools seem inevitable. The calculator and the microcomputer are the first instructional devices available to all students.

In summary, both of these instructional devices can benefit students by:

Reinforcing the basic skills

Helping in the basic skills of reasoning

Reinforcing problem solving ability

Promoting logical thinking

Encouraging creativity

Providing stimulation and motivation

Helping to develop number sequencing concepts

Aiding in discovering mathematical concepts

All of this has important implications for teacher education. Changes in methods of teaching will take place. It is essential that those who will teach future citizens be prepared to introduce them to the tools which they will use and which will affect their lives in so many ways. Teachers must be trained to use calculators and microcomputers in educational settings.